1   1. A method of compressing a two-dimensional image represented as a raster of pixels,

2   each pixel having a value, the method comprising:

3   receiving a sequence of the pixels in raster order;

4   defining a first match pixel location and a second match pixel location relative to a

5   current pixel location in the raster, a first match pixel being the pixel at the first match

6   pixel location relative to the current pixel, a second match pixel being the pixel at the

7   second match pixel location relative to the current pixel, where the first pixel location and

8   the second pixel location are not contiguous in the sequence;

9   considering each pixel in turn as the current pixel, performing the actions of:

10   comparing the current pixel only to the first match pixel and the second

11   match pixel and then encoding the value of the current pixel if the value of the current

12   pixel does not match the value of the first match pixel or the value of the second match;

13   and otherwise

14   if the value of the current pixel matches the value of the first match pixel

15   then encoding the current pixel as a first token where the first token includes a reference

16   to the first match pixel and a length and where the length is determined based on a

17   number of consecutive pixels relative to the current pixel whose values match the values

18   of similarly located pixels relative to the first match pixel; or

19   if the value of the current pixel matches the value of the second match pixel

20   then encoding the current pixel as a second token where the second token includes a

21   reference to the second match pixel and a length and where the length is determined based

22   on a number of consecutive pixels relative to the current pixel whose values match the

23   values of similarly located pixels relative to the second match pixel.

1   2. The method of claim 1 where the first match pixel is the pixel immediately previous to the

2   current pixel in raster order.

1   3. The method of claim 1 where the second match pixel is positioned immediately above the

2   current pixel in the raster.

1   4. The method of claim 1 where the second match pixel is positioned adjacent to a pixel
2   immediately above the current pixel.

1   5. The method of claim 1 where the second match pixel is positioned in a previous scan line.

1   6. The method of claim 1 where the length is unbounded.

1   7. The method of claim 1 including encoding the length including storing a code and a value,
2   the code representative of a range of length values that are encoded and the value indicative
3   of an exact length value within the range.

1   8. The method of claim 1 further comprising gathering statistical data.

1   9. The method of claim 8 wherein tokens are classified into groups and statistical data is
2   gathered on how often each token group type is used.

1   10. The method of claim 9 further including gathering statistical data for a number of
2   encoded tokens having lengths falling within each of a number of predetermined ranges of
3   lengths.

1   11. The method of claim 1 where encoding the current pixel value as a literal includes
2   encoding the value of the current pixel in accordance with a predefined mathematical
3   algorithm operating on the pixel value.

1   12. The method of claim 11 where the mathematical algorithm includes determining a
2   distance between the current pixel value and a value of a pixel immediately preceding the
3   current pixel and encoding the distance.

1   13. The method of claim 1 where if the current pixel can be encoded as either the first token

2   or the second token, the current pixel is encoded as the first token if the length referenced in

3   the first token is longer than the length referenced in the second token and otherwise the

4   current pixel is encoded as the second token.

1   14. A method of compressing a two-dimensional image, the two-dimensional image divided

2   into a sequence of scan lines where each scan line includes a sequence of pixels and where

3   each pixel has an associated value representative of a shade to be rendered when displaying

4   the two-dimensional image on a raster output device, the method comprising:

5   processing pixels in raster order including, for each pixel, comparing the value of the

6   pixel with values of a plurality of previously processed pixels, and if a match is detected then

7   encoding the pixel as a reference to a matching pixel and a length where the length is

8   determined based on a number of consecutive pixels that satisfy a matching criterion where

9   the matching criterion is defined by a relationship between the pixel and the matching pixel;

10   and

11   if the value of the pixel does not match the value of any of the plurality of previously

12   processed pixels then encoding the pixel value.

1   15. A method of generating a compressed representation of a two-dimensional image where

2   the image is described as a sequence of pixels in raster order, the method comprising:

3   receiving the two-dimensional image as a sequence of pixels in raster order;

4   for each pixel, determining whether the pixel is part of a first string of pixels that is

5   identical to a second string of pixels found previously in the image at one of a plurality of

6   preselected fixed distances from the first string of pixels;

7   if so, encoding the first string of pixels as a string token that is a reference to the

8   second string of pixels;

9   otherwise, encoding the pixel as a non-string token.

1   16. The method of claim 15 where one of the preselected fixed distances is one pixel,

2   thereby allowing the first string of pixels to be encoded as a reference to the second string of

3   pixels that occurred one pixel earlier in the two-dimensional image.

17. The method of claim 15 where one of the preselected fixed distances is a length of one scan line of the two-dimensional image, thereby allowing the first string of pixels to be encoded as a reference to the second string of pixels that occurred directly above the first string of pixels on an immediately previous scan line.

18. The method of claim 15 where the preselected fixed distances are two in number.

19. The method of claim 15 where one of the preselected fixed distances is one plus a length of one scan line of the image, thereby allowing the first string of pixels to be encoded as a reference to the second string of pixels that occurred on an immediately previous scan line, one pixel to the left of the first string of pixels.

20. The method of claim 15 where the preselected fixed distances are fewer in number than the maximum fixed distance.

21. The method of claim 15 where a length of the first string of pixels is unbounded.

22. The method of claim 15 where the string token is encoded by encoding the preselected fixed distance from the first string of pixels to the matching second string of pixels and a length of the first string of pixels.

23. The method of claim 15 where the string token or non-string token is encoded based on one or more previously encoded tokens preceding the string token or non-string token.

24. The method of claim 15 further including encoding a single pixel as a ranking based on a distance of its value from a value of a previous pixel.

1   25. The method of claim 15, wherein the step of encoding the first string of pixels as a

2   reference to the second string of pixels includes dividing tokens into groups and encoding a

3   token by encoding its group and encoding the particular token within a given group with a

4   code.

1   26. The method of claim 25, wherein the token within a group code can be variable length.

1   27. A method of generating a compressed representation of a two-dimensional image as a

2   sequence of encoded tokens, each token representing either a first string of pixels that is

3   identical to a second string of pixels that occurs previously in the image or a single encoded

4   pixel value, given an uncompressed representation of the image as a sequence of pixels in

5   raster order, comprising:

6   receiving the sequence of pixels;

7   for each pixel, determining whether the pixel is part of a first string of pixels that is

8   identical to a second string of pixels found previously in the image at one of a plurality of

9   preselected fixed distances from the first string of pixels;

10   if so, encoding the pixel in the first string of pixels;

11   otherwise, encoding the pixel.

1   28. A method of generating an uncompressed representation of a two-dimensional image as

2   a sequence of pixels in raster order, given a compressed representation of the image as a

3   sequence of encoded tokens, each token representing either a first string of pixels that is

4   identical to a second string of pixels that occurs previously in the uncompressed

5   representation of the image or single encoded pixel value, comprising:

6   sequentially retrieving the encoded tokens;

7   decoding each encoded token;

8   if a token represents a first string of pixels, outputting the first string by copying a

9   second string of pixels specified by the token;

10   otherwise, outputting a pixel having a value specified by the token.

1   29. A digital output processing system with object compression and decompression for

2   processing a two-dimensional image comprising:

3   a rasterizer which converts data objects into bitmap objects;

4   a compressor operable to receive the bitmap objects as a sequence of pixels in raster

5   order and for each pixel,

6   determine whether the pixel is part of a first string of pixels that is identical to

7   a second string of pixels found previously in the two-dimensional image at one of a plurality

8   of preselected fixed distances from the first string of pixels;

9   if so, encoding the first string of pixels as a reference to the second string of

10   pixels, and

11   otherwise, encoding the pixel; and

12   a decompressor which decompresses the compressed bitmap objects.

1   30. A digital output processing system as recited in claim 29 wherein the compressor and

2   decompressor are implemented in an output device.

1   31. A digital output processing system as recited in claim 30 wherein the output device is

2   one of a group consisting of a printer device and a screen display.

1   32. A digital output processing system as recited in claim 29 further comprising a

2   mechanism for dividing the bitmap objects into nonintersecting regions, wherein the

3   compressor compresses the regions.